Exceptional late recovery of prehension after ischaemic stroke: A kinematic and neuroanatomic study (fMRI and DTI)

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Keywords: Stroke; Prehension; Recovery; fMRI; DTI; Cerebral plasticity

Background.– Recovery of a selective prehension after a complete impairment after stroke is rare. Most often, recovery is partial and occurs during the first six months. We report an exceptional case of late recovery of a good prehension ability that occurred between the fifth and the ninth year after a left total sylvian stroke.
Methods.– Recovery was followed by a kinematic analysis of a prehension movement 5, 9 and 12 years after the stroke, and compared to the data of 6 paired healthy subjects. A DTI MRI and an fMRI during a finger-tapping task were realized and compared to the data of 10 healthy subjects.
Results.– The patient shows a rough motricity of the fingers at 2 years, a two-fingers grip at 4 years and a grip comparable to that of the controls at 9 years. The DTI analysis shows a partial lesion of the left M1 area and cortico-spinal tract. The finger-tapping task of the impaired limb elicits an activation of the spared part of controlateral M1 and of the ipsilateral M1.
Conclusion.– Late recovery of a bidigital prehension after stroke is associated to a plasticity of controlateral and ipsilateral M1.

http://dx.doi.org/10.1016/j.rehab.2014.03.648

CO06-004-e

Usability of non-invasive brain computer interface systems for upper limb recovery after stroke

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Keywords: Stroke; Motor recovery; Upper limb; Brain-computer interface; Effectiveness

Background.– Non-invasive brain computer interface (BCI) is a computer-based communication system in which brain activity signals are recorded and translated into motor commands for an output device (robot, orthosis, FES) to perform a desired action. The aim of this study is to revise usability of non-invasive BCI for upper limb recovery after stroke.
Methods.– A review was carried out of articles published over the last five years in Medline- PubMed, including randomized clinical trials and case series. MesH key words used were: stroke, motor recovery, upper limb, brain-computer interface, effectiveness.
Results.– Motor imagery based EEG-BCI coupled to FES or robotic devices may improve finger extension, grip strength and upper limb motor function in chronic stroke patients. Motor improvements are correlated with cortical excitability changes assessed with transcranial magnetic stimulation. stroke patients is influenced by its clinical effectiveness and interface design. Use of new sensors (i.e. dry electrodes) can facilitate the brain signal acquisition process. Monitoring patient physiological responses to detect fatigue or stress linked to BCI training also could improve BCI usability. Future advances on BCI technology may consolidate its use on clinical settings.

http://dx.doi.org/10.1016/j.rehab.2014.03.649

CO06-005-e

CIPASS: Trial of a daily program of cerebral stimulation by TMS using a PAS paradigm in the recovery phase of stroke patients

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Background.– CIPASS (Chronic IPAS in Stroke) is a new neuromodulation protocol where a PAS (Paired Associative Stimulation) session is performed during 5 days to stroke patients. Our goals are to demonstrate a lasting increase (3 days) of motor cortical plasticity for extensor wrist muscles (ECR), and a functional improvement.
Methods.– PAS consists of a combination of 2 stimulations: electric and TMS (0.1 Hz) over 30 min. This is a randomized, double-blind and placebo-controlled trial. Twenty-four patients (PAS: $n = 12$ and Placebo: $n = 12$). One session of PAS stimulation was applied on a daily basis (5 days).
Results.– Our first results have demonstrated, 3 days after the end of the last PAS session (J8), an important increase of MEP surfaces for group PAS ($+125\% \pm 218\%$), compared to group Placebo ($+28\% \pm 83\%$). FMMS improvement was slightly higher for group PAS ($+5.3 \pm 4.5$ pts) than group Placebo ($+4.5 \pm 3.8$ pts) at J8.
Discussion.– CIPASS seems to induce long-term (3 days) changes in group PAS; motor effects seem however less conclusive. This trial will help us to better understand brain plasticity processes and to prove the relevance of CIPASS use as a therapeutic adjunct in stroke rehabilitation.

http://dx.doi.org/10.1016/j.rehab.2014.03.650

P338-e

Instrumented objects for the study and quantitative evaluation of grasping and manipulation strategies

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Keywords: Instrumented objects; Grasping; Manipulation; Assessment

Impairment of grasping ability is very frequent in stroke survivors. However, despite the importance of this question and the numerous rehabilitation techniques dedicated to grasping, there still lacks comprehensive studies on grasping function and manipulation after stroke. In addition, there is also a lack of pertinent methods for the assessment of grasping function in hemiparetic patients; along with devices to evaluate patients' motor performances in a simple way.
We therefore developed a set of instrumented objects that can be grasped and manipulated by patients while wirelessly recording accelerations, orientations and forces applied over their surfaces. We present here the results obtained with one of this object (an instrumented rectangular box). An experimental protocol based on grasping/lifting and manipulation tasks was developed and run on a population of healthy subjects. Analysis was conducted on the data recorded, thanks to suitable developed metrics (timings analysis, force levels and repartition over the object, smoothness etc.).
Results indicates that such simple instrumented object could be suitable to characterize sensorimotor impairments, which may help the understanding of